Application of Information Theory, Introduction

Iftach Haitner

Tel Aviv University.

October 28, 2014

Section 1

Administration

Important Details

1. Iftach Haitner. Schriber 20, email iftachh at gmail.com
   Reception: Sundays 9:00-10:00 (please coordinate via email in advance)

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     subscribe 0368-4486-01 <Real Name>

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4. Course website:
   `.../~iftachh/Courses/Info/Fall14/index.html`
   (or just Google iftach and follow the link)

Grades

1. Class exam 80

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2. Homework 20%: 5-6 exercises.

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   - Exercises should be sent to nisnis.levi at gmail.com or put in mailbox ?, in time!

and..

1. Slides

and..

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2. English

Section 2

Information Theory

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- One of the most important scientific papers of the 20'th century. Revolutionized EE, and ideas from this papers are central in almost all area of science: Physics, Mathematics, Computer Science,Chemistry, Biology.
- An amazing example of an amazing research done by mainly by asking the right questions.

Section 3

The Course

Course Topics

Information Theory is typically taught in EE. In this course we will focus on the point of view of CS and Math, and less on EE applications.

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- Axiomatic derivation of Shanon's entropy
- Conditional entropy and mutual information
- Relative entropy (Kullback-Leibler information)
- Entropy of a continuous random variable
- The maximum entropy principle
- Huffman coding
- The asymptotic equipartition theorem
- Data compression
- Channel capacity
- Shearer's inequality
- Applications to combinatorics
- Kolmogorov complexity

Course Topics cont.

Second part of the course will focus on computational notions of entropy.

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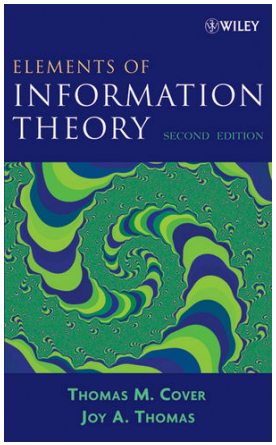
- Parallel repetition of interactive argument
- Pseudo entropy and pseudorandom generators
- Accessible entropy and statistically hiding commitments

Material

- Books:
  Thomas Cover & Joy Thomas: Elements of Information Theory.



- Papers:
  - Jaikumar Radhakrishnan: Entropy and Counting.
  - Thomas Holenstein: Parallel Repetition: Simplifications and the No-Signaling Case.

- Lecture notes:
  - Anup Rao.
  - Venkatesan Guruswami and Mahdi Cheraghchi .

Prerequisites

Basic probability and calculus.